REMARKS

The present amendment serves to delete the portion of claim 1 pertaining to the negative anisotropy of the substrate previously inserted into claims 1 and 15 from original claim 4. As is apparent from the discussion of the references below, this claim limitation is not necessary to distinguish the present invention from the art and unduly restricts the claim scope. Both claims 1 and 15 have also been amended to make it clear that the VA cell of the invention has a cell where the LC molecules are perpendicular to the substrate in the "off-state", as described at page 1/ lines 25-28 of the specification.

According to the Examiner, Claims 1 and 15 are rejected pursuant to 35 USC 112 due to the recitation: "...wherein the two planes are perpendicular to each other" being indefinite and unclear. The Examiner notes:

> The two planes are perpendicular to each other that means one plane located in one direction such as parallel to the horizontal direction, and the other plane is located in one direction such as perpendicular to the horizontal direction that is the vertical direction, but how a LCD device has a horizontal plane and a vertical plane in the device. For examination purpose, the two planes are perpendicular to each other means that the optic axes in planes are perpendicular to each other.
>
> Claims 6-9, 11-14, 20-24 are dependent on claim 1, and claims 16-19 are dependent on claim 15. Therefore, all the dependent claims have the deficiency set forth above.

Appellants believe that the language of the claim is definite and clear. The claims recite that

> "...the first and second positive birefringent materials are each oriented with their optic axis (which in the case of a positive or rod-shaped anisotropic material is the long axis of the rod) <u>tilted</u> in *planes perpendicular to the liquid crystal cell surface and wherein the two planes are perpendicular to each other.*" (italics emphasis added).

The two layers of positively birefingent material in the compensator are both tilted in planes perpendicular to the LC cell. Thus, neither plane can be "horizontal". The first part of the italicized part of this limitation makes it clear that if one draws a plane perpendicular to the cell surface oriented so that it contains the optic axis of the first tilted molecule and another plane

perpendicular to the cell surface oriented so that it contains the optic axis of the second tilted molecule, then these planes will intersect the surface of the cell at projection lines **60** and **62** of FIGS 6D and 8C. They cannot be horizontal. The remainder of the italicized portion of the claim limitation then also provides that the planes represented by projection lines 60 and 62 are perpendicular to each other which simply means they form a 90° angle (between **60** and **62**) where the planes (both perpendicular to the surface) intersect each other. No lack of clarity is seen in this language. The Examiner is requested to be more specific if this rejection is continued and to provide examples on how this relationship is unclear.

Turning to the prior art rejection, Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of four references

(1) Applicant admitted prior art (AAPA) in view of

(2) US 2004/0051832 A1 (Shimoshikiryoh),

(3) US 5,747,121 (Okazaki et al) and

(4) US 6,081,312 (Aminaka et al).

Claims 8, 14-15, 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over AAPA, Shimoshikiryoh, Okazaki and Aminaka as applied to claim 1 above, and further in view of US 6,319,963 (Coates et al).

As set forth in independent claim 1, and illustrated in FIGs. 8A-D and 10A-D, the claimed invention is directed to an imaging component comprising the following (FIG numeral in parenthesis, Specification Reference in brackets)

(1) a vertically aligned nematic liquid crystal cell (45) [5/25-6/22] in which the optic axis of the cell molecules is perpendicular to the cell surface in the off-state [1/25-28],

(2) a polarizer disposed (12,18) on each side of the vertically aligned liquid crystal, the polarizers having polarization axes orthogonally crossed with respect to each other in a direction normal to the cell surface 8/21-25] , and

(3) a compensation film (74 or 84) [6/23-8/18] disposed between the liquid crystal cell and a polarizer that comprises (a) a first positive birefringent material (56) disposed on a base film (44) and (b) a second positive birefringent material (58) disposed on the said first positive birefringent material, (c) the first and second positive birefringent materials each oriented with their optic axis tilted

in planes perpendicular to the liquid crystal cell surface and (d) wherein the two planes are perpendicular to each other. (60,62) ($\phi_2 = \phi_3 - 90°$) [8/8-18]

As explained in the background of the invention, the device of the invention seeks to improve the quality of a liquid crystal (LC) display. Such displays employ an array of LC cells that selectively permit light to pass or not on a pixel-by-pixel basis. Crossed polarizers are designed to stop passage of light when desired but the image quality is diminished due to leakage of off-angle light traveling through the cells resulting in an unwanted directional dependence of contrast and color as a function of viewing angle. Viewing angle dependence should be kept to a minimum for high quality displays.

The LC cells of the claim are nematic meaning they are rod-shaped rather than disc-shaped. They are uniaxial (refractive index the same along two coordinates but not the third) with positive anisotropy, having a larger refractive index in the length-wise direction (Z) and a second smaller refractive index in both the X and Y directions and are aligned so they are perpendicular to the substrate in the "off-state". See FIG 6A. The length-wise direction of the rods can be represented by an arrow indicating the optic axis. LC molecules can thus be selectively oriented by applying an electrical potential across an LC cell in order to control the orientation of an anisotropic material, thereby affecting the ability of the cell to pass or block light. In one orientation light will pass and in the other it will not, thus resulting in a desired image. There are many types of LC cell types. Taking X and Y as orthogonal to each other in the plane of the LC cell or substrate surface (same as orthogonal to the light direction or cell normal) and Z in a direction orthogonal to the X-Y plane or cell surface (same as parallel to the light direction and cell normal), all as shown in FIG 1, the following types of molecular reorientation are among those that have been proposed in LC cells:

(I) Vertically aligned: as one turns a cell on or off, the molecules move from being lengthwise in the Z direction (vertical or perpendicular to the substrate) to a tilted position. In the VA cell of the invention the molecules are vertical in the "off-state".

(II) Bend aligned: as one travels the path between electrodes from one surface of the cell to the other, molecules move from a generally vertical or

horizontal position (the X or Z direction) to a curved orientation varying along a path going from one electrode to the other;

(III) Twisted: as one travels the path between electrodes from one surface of the cell to the other, the molecules twist 90° gradually moving from being oriented in the X direction to being oriented in the Y direction;

(IV) Super-twisted: same as "twisted" but the molecules twist 270°;

(V) In Plane: The electrodes, instead of being locate at opposite surfaces of the LC cell, are located at opposite edges of the cell and shift the molecules from the X to the Y direction.

Each of the general cell types creates unique light loss problems. The compensator will ideally function to correct all light loss and related problems engendered by the LC cell. How well this is accomplished is measured by the Viewing Angle Characteristic (VAC) which measures the contrast variation as a function of viewing angle for different levels of contrast. The observed contrast is measured around 360° azimuth and, for each azimuthal direction, at polar angles of 0, 20, 40, 60, and 80° from the cell normal from the plane of the cell normal. The larger and more circular the iso-contrast lines, the less angle dependence there is. Compare Figures 9A, B, and C to Figure 4B.

Thus, claim 1 provides a compensator arrangement that provides reduced viewing angle dependence in the case of a vertically aligned nematic LC cell with a vertical "off-state" position. When such cells are used for transmission displays, crossed polarizers are employed as the means of selectively passing light. Light passing orthogonally through one polarizer will not also pass through the second polarizer unless the LC cell is energized to reorient the LC cell molecules. The compensator seeks to correct for any undesirable light loss and redirection occasioned by the LC cell.

Referring to Figures 10A through 10D and Figures 6D and 8A-C, the arrangement of claim 1 is illustrated. FIGS 10A-D show a compensator film (74) between the cell (14) and the polarizer (18). FIGS 6D and 8A-C show compensator detail with the support (44) bearing two layers of positive birefringent material (56,58) each of which are tilted in planes perpendicular to the LC cell surface (the same as in planes parallel to the normal to the cell

surface). The relationship between the plane projection 60 and the plane projection 62 is shown as either $\phi_2 = \phi_3 - 90°$ or $\phi_2 = \phi_3 + 90°$. In both cases the planes are 90° apart and thus perpendicular as shown in FIG 6D.

As set forth in independent claim 15, and illustrated in FIGs. 8A-D and 10E and F, the claimed invention is directed to an imaging component comprising the following

(1) a vertically aligned liquid crystal cell (14) in which the optic axis of the cell molecules is perpendicular to the cell surface in the off-state [1/25-28] disposed between a polarizer (12) and a reflective plate (88), and

(2) a compensation film (84) is disposed between the vertically aligned liquid crystal cell and the polarizer,

(3) wherein the compensation film comprises a (a) first positive birefringent material (56) disposed on a base film (44) and (b) a second positive birefringent material (58) disposed on the said first positive birefringent material, (c) the positive birefringent materials each oriented with their optic axis tilted in planes perpendicular to the liquid crystal cell surface and wherein the two planes are perpendicular to each other. (60,62) ($\phi_2 = \phi_3 - 90°$) [8/8-18]

This device is similar in scope and objective to that of claim 1 but is designed for reflective rather than transmissive imaging and thus relies on an arrangement including a single polarizer and a reflection plate.

All of the claims require that the compensator contain two layers on a substrate and that the positively anisotropic material in those layers be oriented so that the optic axis (lengthwise direction) is tilted in respective planes that are simultaneously perpendicular to the substrate and to each other.

AAPA shows only one layer in the compensator and the optic axis of that layer is <u>not tilted</u> but is in a plane parallel to the substrate. Okazaki only teaches a single anisotropic layer on one side of the LC cell. Also, the layer of Okazaki is desirably a negatively birefringent material (pancake- rather than rod-shaped). See FIG 4 and col. 36/47-50 of Okazaki. Okazaki is not about a VA cell. It is about the twisted nematic (TN) type of cell.

The enclosed Declaration under Rule 132 confirms that compensators must be matched to the type of LC cell employed. Section A of the Results at page 4 of the Declaration sets forth the test results when compensators useful for a VA cell on the one hand and a Twisted Nematic (TN) cell on the other hand are switched. Figures B and D show that the lack of contrast

uniformity with viewing angle is totally unacceptable for the mismatched arrangements. Thus, the teachings of Okazaki can not be combined with AAPA and

Aminaka also fails to suggest the arrangement with two layers on a substrate and that the positively anisotropic material in those layers be oriented so that the optic axis (lengthwise direction) is tilted in respective planes that are simultaneously perpendicular to the substrate and to each other. Aminaka only suggests a single plate containing negatively birefringent material on each side of the cell. There is no suggestion to use two tilted layers nor to use layers of positively birefringent material. Examples of Aminaka refer to only a single orientation direction of the compensation sheet which would not be effective to provide two such layers oriented orthogonally.

As more thoroughly show in the enclosed Declaration in section B of the results at page 7, the viewing angle results using the single negatively birefringent layer of Aminaka are far less effective (<70°) than the present invention (57-90°) as demonstrated in the Examples 1-3 and the VAC charts related thereto in the present application.

Shimoshikiryoh also fails to suggest the arrangement with two layers on a substrate and that the positively anisotropic material in those layers be oriented so that the optic axis (lengthwise direction) is tilted in respective planes that are simultaneously perpendicular to the substrate and to each other. In FIG 5, Shimoshikiryoh shows a positive A-plate and a biaxial plate. An A-plate is one with its optic axis in a plane parallel to the substrate ([0134] of Shimoshikiryoh. Therefore it is not tilted and does not meet the claim requirements. The reference biaxial plate is comprised of molecules where they do not contain a common refractive index in two directions. The RI is different in each of the X, Y, and Z directions. The term positive birefringence has no clear meaning is such circumstances. Thus, neither the parallel A-plate nor the the biaxial plate meets the claim requirements.

None of the references suggests the layer arrangement of the claims and there is no motivation for one to arrive at the combination from any combination of the references cited.

In view of the foregoing amendments and remarks, the Examiner is respectfully requested to withdraw the outstanding rejection and to pass the subject application to Allowance.

Respectfully submitted,

Attorney for Applicants
Registration No. 25,518

Arthur E. Kluegel/dlm
Telephone: 585-477-2625
Facsimile: 585-477-1148
Enclosures

If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

Encl: Declaration Under Rule 132